# MARINE CAMOUFLAGE BROUGHT TO PERFECTION IN AMERIC

By LINDELL T. BATES, Secretary of the Submarine Defence Association, graduate of Yale, '10, holder of seven degrees in law and the Knight's troop of Isabel la Catolica from the Ling of Spain.

'amouflage has had almost as fasciting an evolution in marine as in land arfare. In many respects, however, it the youngest science, and until March, its, it might rather be called an art

he lessons of visual deception to the car. Early in the U beat campaign they exam to paint their vessels in various essens to make them less conspicuous. In the late nineteenth century British arships used to be black in color, and merican white. In sea fights at fairly lose range low visibility was not conducted of great importance. In the conducted of great importance. dered of great importance. In the 90's ire Germans changed from black to dark eray. Great Britain and the other Pow-ers shortly thereafter followed suit, but ifferent shades of gray were used by ifferent nations. Dark gray, called reattleship gray." was the prevailing plor. At the outbreak of hostilities the French, Italian and Austrian fleets were of a color different from those of the British and Germans. The former fa-cored a gray and khaki mixture. The tch ships were greenish brown in hue. 1914 Austria adopted the German or for the sake of uniformity with

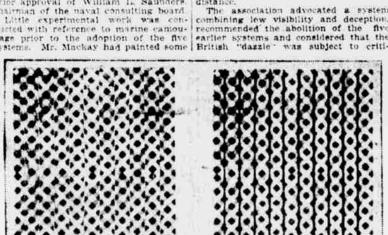
Prior to the entry of the United States nto the war the Allies had made no ctable effort to disguise their vessels as selp in the struggle against the U boat peir white or light colored upper works gray or dull stone color. Some vessels-ere decorated early with false painted ows and how waves, or a silhoustic of distroyer, a submarine or a sinking

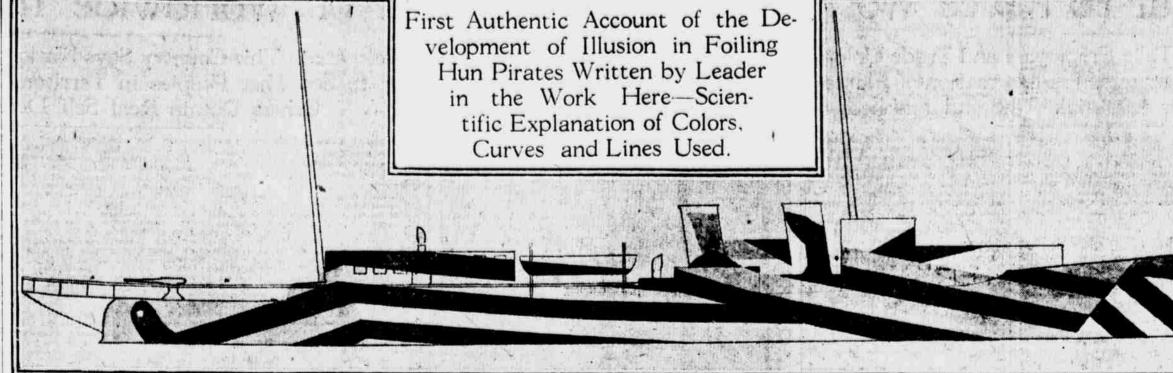
# Artists Took In the Work.

erested in its marine possibilities, cablished a marine camouflage school lev York city, the first of its kind. nto two groups, those who favored ting for low visibility and those favored a so-called "dazzle" sys-Mr. Mackay's original system was low visibility, as was that of Mr. M. Warner considered decepter major and low visibility of minor

Messra. Herzog and Toch reconcile both aims The United States Shipping Board and "Protective to interest in the possibility of camou- of Defence Aga age as a defensive measure for Ameri- Lieyd A. Jones. biference of the Reports.

The Treasury Department through an order requiring under penalty per cent increase in war risk minum the palanting of vessels for moke elimination and of making friendly purposes. Ship owners were thereby to select either of five systems intomed. Should an owner wish of swore a different scheme, the required him to obtain for it the expression of the naval consulting board. Little experimental work was contended the abolition of the five state of the adoption of the five state of the he Bureau of War Risk Insurance is-sued an order requiring under penalty





The last word in marine camouflage. This freakish looking craft eluded searchlights and keen-eyed coast artillerymen near by.

person in this country. For the execu-tive direction under the higher naval officers Harold Van Buskirk was desig-by the person in this country. For the executive direction under the higher naval.

The visibility problem is affected also by the manner in which ships voyage, whether alone or in a group. Prior to the and he had shown tact and ability and could be released from duty with the association to go to the navy. These men were made Schior Lieutenants and transports. In 1917 and 1918, however, the problem is affected also by the manner in which ships voyage, whether alone or in a group. Prior to the entry of the United States into the war the executation to go to the navy. These men were made Schior Lieutenants and transports. In 1917 and 1918, however, the problem is affected also by the manner in which ships voyage.

If, on the other hand, for tactical reasons the torpedo is selected as the way of the problem. The visibility problem is affected also by the manner in which ships voyage.

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If on the other hand, for tactical reasons the torpedo is selected as the torpedo is selected In the course of the war several nated because he was the most availa-tmerican artists, noting the rapid de-elopment of land camouflage, became and could be released from duty with men were made Senior Lieutenants and transports. In 1917 and 1918, however, they were the nucleus of the new Navy large convoys of from twenty to forty

sociation terminated its research work and published two marine camouflage reports entitled "The Science of Low Visibility and Deception as an Aid to the Defence of Vessels Against Attack by Submarines." by Lindell T. Bates, and "Protective Coloration as a Means of Defence Against Submarines." by Lindell T. Bates, and "Protective Coloration as a Means of Defence Against Submarines." by Lindell A Jones.

of the Shipping Board of ship painting from designs supplied by the navy. While these developments were taking place bit in the convoy.

Licut. Wilkinson arrived, bringing with him ninety more "dazz's" patterns. The previous ninety were siready considered obsolete.

In March the Submarine Defence Assume that the submarine Defence Assume that the submarine processes according to speed. It happened, however, that vessels of less than a certain minimum rate hamper a convoy over much and were not included in it. Fast the submarine processes are also excluded, as with their to according to speed of the merchantman or convoy. These data cable him to calculate where the irring positive vessels were also excluded, as with their to according to speed of the merchantman or convoy. These data cable him to calculate where the irring positive vessels were also excluded, as with their to according to speed to the submarine commander takes from six to obtain the convox.

While submerged the center. In case of convoy and single vessels of the convoy.

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While submerged the convox will be accorded to other and the convox of the

Smoke a Dangerous Factor.

Fueling practice is also a factor in the visibility study. American vessels were required by the Bureau of War Risk Insurance, under penalty of increased premium, to burn smokeless fuel or anthractic in the danger zone. Incomuch as other ships were not always similarly regulated and convoys were composed of foreign as well as American vessels, smoke clouds always formed above convoys. It was not possible either in all cases to obtain smokeless from the funnels of vessels travelling alone or in company through the danger tone.

The most important of all visibility factors is weather. The yearly "proport."

With respect to protective camouffage.

In the lens, and are smill to the masts, funnels of the vessel under observation are on a level with the masts, funnels of the vessel under observation are on a level with the descending of the second image. The angle of shift determines the distance.

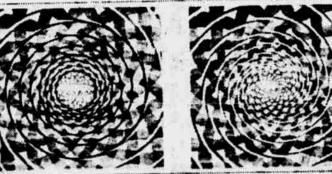
The angle of shift determines the descend image. The angle of shift determines the distance.

The angle of shift determines the vessel under observation are on a level with the distance.

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The angle of shift determines the vessel under observations are the observation are on a level with the fire will be actually at longer range than the submarine captain anticipates. If, on the other hand, the ship is made to appear more distant than the really is, then the torpedo may be aimed to appear more distant than the really is, then the torpedo may be aimed to appear more distant than the really is, then the torpedo may be aimed to appear more distant than the really is, then the torpedo may be aimed to appear more distant than the really is, then the torpedo may be aimed to appear more distant than the really is, then the torpedo with the waster of a percentage of the will be actually at longer range than the submarine captain anticipate

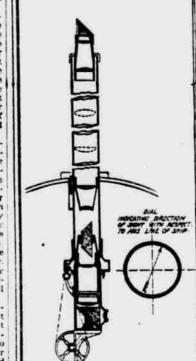


that Mr. Jones was the best equipped Eric Geddes, occurred in the Mediter most submarines. The guns on mer-person in this country. For the execu-ranean, chant vessels were often outranged. The

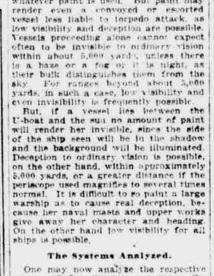
toth of New York, appear to have been they were the nucleus of the new Navy bed of this country and abroad, he hould not this country and abroad, he hould not this question simultaneously a post with them, but Mr. Mackay remained not not he new field. Mr. Mackay even the nucleus of the new Navy Camouflage Section.

This is abreast or slips proceeded from American and the supplements of the five American camouflage artists Everett L. Warner was chosen for a post with them, but Mr. Mackay remained in New York as a local executive of the new field. Mr. Mackay even stabilished a marine camouflage school that the new field. Mr. Mackay even the new field th

knots in speed. European coastwise vessels and ships proceeding to certain Mediterranean ports. Sometimes therefore victims were alone on the sea, sometimes the compensated among other ways, howevest.



Periscope of a U-boat, with direction of sight dial.



recorded on July 9, 1917, regarding the Mackay system: "Fundamentaly it is based on mottling."

runnamentally it is based on motting the surface with the three primary colors which at a distance blend to produce a gray having the quality of a gray light. He also proposes to shade the tints so as to lower high lights and raise the low areas of illumination.

This was classed as a system (or vestels "with in our opinion will lower sels "which in our opinion will lower their visibility. The theory of Mr. Mackay's low visibility system is given by him in the following language:

The proportion of constituent colors to give white are: Violet 44, red 36, green 29. Therefore areas covered with these three colors in this proportion would give a general over-all gray. With the colors in this proportion the ground color would be violet."

It is not clear how three different olor effects can be produced by the ame formula. At a subsequent date Mr. Mackay supplemented his "low visibility object with a 'dazzle' purpose and pro-duced a system which he calls one of

Demois Union of line: the bands are verigin, for you was all and the property of the property disruptive coloration."

The Warner system aims primarily to "dazzle" rather than to reduce visi-bility. Various irregular patterns are carried out in the shades red, blue, pigk.

yards, in such a case, low visibility and able, some protection may be afforded of the war came to favor also such a very invisibility is frequently possible. But, if a vessel lies between the confuse the enemy and by causing some tions of the ship.

Deception to ordinary vision is possible, systems rested. They were impression is possible, Experiments have seen on the other hand, within approximately still systems devised by artists, and not seen the scientific systems devised by light and tands and other designs to over capetts. Their sponsors deserve, handless, but without success so for 1. warship as to cause real deception, because her naval masts and upper works new field for research.

The for this reason that the low cause her naval masts and upper works new field for research.

The Systems Analyzed.

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One may now analyze the respective series of five American systems, the visibility is attainable and that a par- and island Z at some cards most the control of the contro British "dazzle" and the navy camoutteular shade of gray which he calls steering a sinuous course need to the latter, and then went camouflage practiced during the Europear war. The Naval Consulting Board recorded on July 9, 1917, resemble. danger zone, where the average weather tance of about 3.000 yard, from the is 70 per cent, cloudy, and below that line nearest searchlight, where there is trequent haze. For the southern portion of the danger zone a departure was known she passed through bluer tone of gray called psi gray was all five searchlights wholly underected found the best Latitude 15 degrees north and was picked up only when after passes a suitable dividing line of the areas in ling through the channel she furned on

as to distort the apparent perspe-

so as to distort the apparent perspec-tive the course may be made to appear somewhat other than it is.

Checkerboard patterns blur outline.
In art and architectural drawing the principles of perspective representation have been a outlically studied for cen-turies. It is quite feasible to peint a turies. It is quite feasible to pelut a vessel in such a fashion as that the apparent perspective is different from the real. This will induce an error in course estimate. A vessel painted with converging bands of colors properly continusted will offer a deceptive appearance as to course. It is possible also to distort perspective by curves or by vertical bands close, together at the bow or stern of the vessel than at the opposite end.

luasmuch as the water line Institute as the water tine of a sept in linewrite be herically a like in the banks chould break the water line. This point is of great moment. No two ships should be painted exactly alike in regard to pattern and convergence of lines. Perspective deseption patterns should beind a state of the second control of the second contro at a distance where deception is no longer possible but low visibility is pos-

that the blending distances of lands and patterns are based upon the hypoth-cells that the periscope does not enlarge the image much above normal vision. If magnification of three to six times nor mil should be resorted to the menoing cistances should be reduced in order that low visuality be not secrimed. It may also be necessary to modify the bleading instances of the bands and patterns to meet a possible attempt to multify by light filters and deceptive effects.

Thesenthon is a matter of my boldary

Deception is a matter of pay thology whatever paint is used. But paint may render even a convoyed or escorted vessel less liable to torpedo attack, as low visibility and despition are possible. Vessels proceeding alone cannor expect often to be invisible to ordinary vision within about 5,000 yards, unless there distort the apparent heading and vision. often to be invisible to ordinary vision the dark colors at the other in order to pound outline binning pattern without who viewed the U.S.S.—— as she is a haze or a fog or it is night, as the vessel.

This scheme is based upon the idea diamond pattern on her how gave her a sky. For ranges beyond about 5,000 that invisibility at sea being unattained seem bow. The British toward the end

"Dazzle" patterns have been tried on U-boat and the sun no amount of paint will render her invisible, since the side of the ship seen will be in the shadow and the background will be illuminated.

In his elaborate technical report upon Tests were also made in July 1918
"Protective Coloration as a Means of Port X to determine the effect of a Defence Against Submarines" Lloyd A. visibility—deceptive coloration—upon Tests were also made in July 1918, off

